J. Highw. Transp. Res. Dev. 2025, 19(1): 61−71

Journal of Highway and Transportation Research and Development

Home page: www.sciopen.com/journal/2095-6215

How do users view time-sharing car: Research of user feedback based on customer journey

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Abstract: A deficit in comprehensive academic research on user feedback for time-sharing cars exists. This study addresses this shortfall by examining 123.8 thousand user posts from Baidu Post Bar's social media. Within a customer journey framework, it gathers and assesses user feedback to chart the progression, repercussions, and triggers of negative experiences. The analysis shows that feedback clusters around car usage, return, settlement, and after-sales stages. Key issues, such as inadequate vehicle conditions, filthy interiors, and post-use violation misassessments, frequently lead to dissatisfaction and distrust, spurring negative word-of-mouth. The study further pinpoints the obsolescence of user supervision technology as a primary cause of user liability risks, including unruly customer behavior and hygiene concerns. This technological lag not only compounds these issues but also triggers a broken window effect through negative word-of-mouth, creating a vicious cycle of deteriorating service quality. Finally, the paper evaluates the efficacy of current service strategies in the time-sharing car industry and suggests strategic directions for future improvement.

Keywords: Transport economics; Time-sharing car; Customer journey; Users' emotional attitude; Word-of-mouth communication; Service improvement strategy

1 Introduction

Time-sharing car system is a car lease business that uses mobile internet, global positioning and information technologies to build a network service platform, providing users with self-service car reservation, return and fee settlement. As urban traffic resources have been saturated and sales for automobile industry continue to fall, time-sharing cars are charged with important missions of replacing private cars [1, 2], and leading automobile industry's service-oriented transformation [3]. Various kinds of policies in China have been encouraging new energy vehicles to enter the time-sharing car field, speeding up the development of leasing models, and expanding the car rental market. However, time-sharing car has experienced a twisted course, including the initial stage, the adjustment and redevelopment stage, and the deep adjustment stage (Table 1). At present, it is faced with severe deficiency of demand driving force, such as low market penetration and low user stickiness. There are same situations in other countries' markets. For example, time-sharing car is operated as a sideline in Japan, operator's main business is automobile manufacturing or chain parking. The operators will only consider investing in time-sharing car when there are redundant facilities in their main business [4]. Time-sharing car market is driven by the supply side rather than the demand side, hence time-sharing car enterprises are inherently short of attention to the demand side. Therefore, from the perspective of demand side, it is worth exploring problems in time-sharing car service and how these problems influence customers' continuous use intention.

Source: Arranged by the author according to online data

The academia carried out researches on time-sharing car which mainly focus on the usage willingness and user portraits during market introduction period, lacking the attention to user feedback during customer journey. Specifically, Lindloff [5], Chun [6], Zhou [7] and Magnani et al.[8] respectively identified the factors that affected usage intention including family economic conditions, travel budget, vehicle demand, personal willingness to share, infrastructure convenience and the transfer convenience to other transport tools. Other studies depicted time-sharing user portraits from the aspects of car use frequency, travel time, travel distance, travel scenarios, etc. [9-18]. These findings are of great benefit to the development of the time-sharing car in market introduction period. However, although the time-sharing car business has been developed for over 10 years in China, and even longer in European countries, there is still a lack of research findings on user feedback during customer journey. Considering that time-sharing car itself is a packaged integrated service including functions such as query, reservation, driving, payment, sharing and other valuable travel services, therefore, user's service experience should be well collected and studied, which is significant to the development of time-sharing car.

In this context, this paper analyzes user feedback in a basic framework of customer journey of time-sharing cars, excavates service stages with more prominent problems, retraces the evolution

Received: 9 January 2024; **Revised:** 27 July 2024; **Accepted:** 18 August 2024
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DOI: 10.26599/HTRD.2025.9480053

Translated from *Journal of Highway and Transportation Research and Development* (Chinese, ISSN1002-0268), 2023, 40(9): 248−256.

Table 1 Development stages of time-sharing car in China.

Time	Stages	Characteristics	Representative cases	Representative policies
2011-2017	The initial stage	The acceptance of time-sharing cars increased rapidly with the development of bike-sharing; industrial policies issued	● In 2011, Chelizi, the first time-sharing car enterprise, was established in Hangzhou ahead of the first bike-sharing enterprise	● In 2017, the Ministry of Transport issued *the Guiding Opinions on Promoting the Healthy Development of Minibus Lease* for the first time
2018-2019	The adjustment and redevelop ment stage	The start-ups with the background of technology or Internet closed down one by one while enterprises with the background of automobiles gained the favor of capital and entered the fast lane of development	● Youyou Travel, EZZY Lease, Bago Travel, Tuge Travel, etc. collapsed due to operational problems ● In 2018, Gofun, Panda Travel, Yibu Travel, etc. raised more than 360 million yuan in total ● Ponycar, Tuge Travel, Like Travel, etc., financed more than 1 billion yuan from 2018 to 2019 ● Xiao'er rental financed 270 million yuan from 2018 to 2019	
2020 to now	The deep adjustment stage	The blind expansion and the impact of epidemic broke the capital chain of some enterprises; the policy is constantly favorable	● From the end of 2019 to 2020, Tomato Travel, Yidao Travel, Youche Travel, Hengyu and Panda Travel issued announcements of business suspension or financial difficulties	● *The New Energy Vehicle Industry Development Plan (2021-2035)* issued by the State Council in 2020 emphasized to accelerate the application of new energy vehicles in time-sharing lease, urban public transport, taxi, site vehicles, etc. ● In 2020, Hainan Provincial Department of Transport issued *the Supplementary Notice on Further Encouraging the Healthy Development of the Time-sharing Lease Industry of the Pure Electric Passenger Car* ● At the beginning of 2021, the Ministry of Commerce issued *the Work Guidelines for Promoting Automobile Consumption in the Commercial Field*, proposing to expand the car rental market and develop multiple rental patterns such as long-term rental, short-term rental and time-sharing rental to meet consumers' diversified and high-quality car rental needs such as "rent from one site and return in more sites", "rent from one city and return in more cities", etc.

process of service problems and their impact on user's continuous use intention, and analyzes the causes of these problems. The last part of this paper will sort out strategic adjustments of enterprises, identify their effects in solving user feedback and improving user experiences. This paper aims to provide improvement suggestions for time-sharing car operation process, and promote researches in the fields of customer journey and sharing economy.

2 Literature review

2.1 Customer journey

Customer journey presents the relationship between users and brands, products or services, as well as users' needs, experiences and feelings in the whole consumption process in a graphical way [19]. Service blueprint can be seen as the origin of customer journey research [20]. Because the whole process includes many touchpoints between users and enterprises, the customer journey map is also called the "touchpoint map". Actually, "not all contacts are equally important, and the improvement of some specific contacts is the key to achieving customer satisfaction" [20], some pleasant or unpleasant key contacts are enough to make customers form the overall evaluation of the service. The earliest service blueprint researches have mentioned the importance of identifying critical moments of service. Some scholars used causation models to analyze the mutual influence of different contacts and their contribution to purchase decisions, helping enterprises identify the most critical contacts at each stage [21, 22]. In general, customer journey decomposes user needs into each interaction with the enterprise, making problems in each service stage easier to understand and recognize. It is one of the effective methods to systematically analyze and manage user experience and identify service quality problems [23].

2.2 Study of customer journey research with new technologies

With the progress of emerging technologies, an increasing number of researches use new technologies and devices to obtain user experience and user feedback information, thereby improving the service experience. On the one hand, new technologies have driven more contacts between enterprises and users. For example, Shankar et al. [24] analyzed the impact of emerging technologies on customer behavior and enterprise behavior in different marketing environments. On the other hand, new technologies also provide more paths to record and explain user experience. Scholars applied mobile communication devices [25], facial expression detection [26], artificial intelligence [27] and interactive devices [28] to collect and interpret customer experience information. For example, with the application of wearable devices, customers are constantly interacting with them, which can help enterprises gather and transmit more user behavior and behavioral intentions [29]. For another example, big data technology has greatly accelerated the collection of users' online browsing and social media interaction. Furthermore, the diversity of user feedback information such as text and video is also enlarged nowadays.

Schweidel et al. [30] divided customer journey signals driven by new technologies into three types: anonymous, privately observable and publicly observable. Publicly observable signal (POS) mainly refers to product recommendation on social media before purchase, product purchase information shared by users on social media during purchase, and product evaluation information published on social media after purchase. On the one hand, POS is the aggregation signal composed of many customers' information, which leads to its large value density of information; on the other hand, all customers, potential customers and enterprises are able to obtain POS which has the lowest information asymmetry [30], making it relatively difficult to arouse users' aversion. As a result, with new technology, POS becomes a customer journey signal source that gives users feedback with the maximum value and has the greatest impact on enterprise management and operation [31]. However, in existing researches, there is no empirical work on customer journey research based on POS sources.

2.3 Research on vehicle-sharing service based on customer journey

Liu et al. [32] used customer journey map and service blueprint

as tools to systematically analyze bike-sharing systems. Wu et al. [33] tracked the whole consumption process of Mobike users and collected problems, opportunities and satisfaction touchpoints in user experience. Wang et al. [34] conducted fieldwork and customer interviews with three groups of young people, middle-aged people and elderly people respectively to collect the experience of Guangzhou citizens in "mobility as a service"(Maas). They created customer journey maps according to the characteristics of personas in different ages, showed the emotional fluctuations and experience pain points in travel, and analyzed the existing problems of Maas services in Guangzhou.

In general, customer journey is an effective tool to record customer experience and improve service design. New technologies including social media provide rich customer information sources for customer journey research. Schweidel et al. [30] believed that it would be an important research agenda in the future to use social media as main POS signal sources to study customer journey, but no corresponding academic achievements have been found at present. Although some scholars have completed customer journey research on vehicle-sharing services, no customer journey research on time-sharing car services has been found yet. Even though, characteristics and hidden danger of vehicle-sharing service can indicate the potential problems of time-sharing car service to a certain extent, which lays a good research foundation for this paper.

3 Data and methodologies

In this paper, a method based on POS signal is proposed to analyze customer journey and explore user service experience, user emotional attitude and interaction behavior, see Fig. 1.

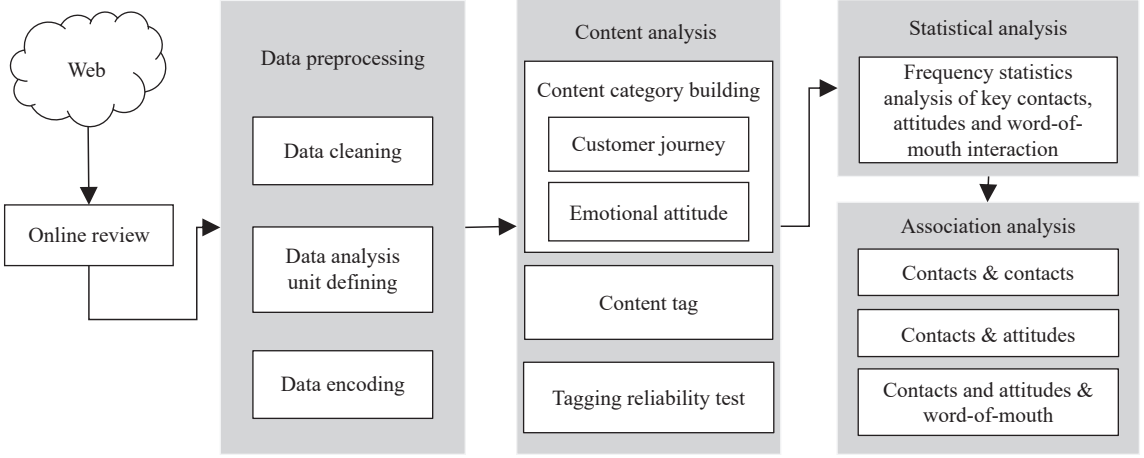

Fig. 1 Process of user feedback analysis based on customer journey.

Firstly, customer reviews of time-sharing car in online forums are collected to build the online review database; then data cleaning, units defining of data analysis are processed; furthermore, the content tag category table of customer journey and emotional attitude are designed, and the reliability of content tag and tagging results were tested to complete the transformation from content data to quantized data; the final step, frequency analysis of consumption stages mentioned in user comments will be done to detect the service key touchpoints in customer journey; and the relevant impacts of unpleasant touchpoints will be analyzed through frequent association items mining among unpleasant points, consumer emotional attitudes and word-of-mouth.

3.1 Data source and data preprocessing

The most common social media channel for user complaints –Baidu Post bar (a top Chinese bulletin board system) [35] is selected in this paper as the source of POS signal. We took 2018-2020 as the time window for research, because time-sharing car industry absorbed a large amount of capital in 2018 and 2019, with those money these enterprises expanded their urban operating areas and car fleets apace, and the industry entered a rapid development period until the end of 2020 (see Table 1 for details). As for the selection of research target enterprises, according to *the Analysis Report on the Market Status and Development Trend of China's Time-sharing Car Industry*, China had more than 1,600 commercial registered enterprises related to "shared cars" and "time-sharing lease", and 130,000 cars in time-sharing lease operation. There were 8 enterprises with more than 10,000 vehicles, namely EVCARD, Gofun, Huaxia Travel, Panda Travel, Chang'an Travel and Like Travel. Therefore, 20,600 theme posts and 103,200 replies were selected from Baidu Post bar with these brand names, including "Shared Car", "EVCARD", "Gofun", "Huaxia Travel", "Panda Travel", "Chang'an Travel", "Mofan Travel (a sub brand of Huaxia Travel)", and "Like Travel" in 2018-2020. Each post contained 8 labels, including "D (post bar account)", "IP", "respondent or post sender", "time", "content", "replied or not", "corresponding reply content", and "keywords or topics".

In the data preprocessing stage, theme posts with no replies were removed. Considering that the views and ideas expressed by each theme post were relatively independent and complete [36], the theme posts and all replies were taken as units of basic analysis. Each unit were numbered as "year +sequence number" (for example: 20 200 001). Taking 2020 as an example, 203,480 original posts including 4,354 theme posts were collected. After data preprocessing, 3,066 theme posts without replies were removed, leaving 1,288 theme posts and their corresponding replies. Sample descriptive statistics are shown in Table 2.

Table 2 Descriptive analysis of samples after pretreatment.

Year	2018	2019	2020
Number of total posts	8 309	6 548	11 503
Number of theme posts	2 799	2 525	1 288
Average number of reply posts	3.0	2.6	8.9
Standard deviation of reply posts	9.1	4.8	24.1
Median of reply posts	2	1	5
Mode of reply posts	1	1	3
Maximum number of reply posts	310	156	509

3.2 Content analysis

Content analysis is a qualitative study based on quantitative analysis [37]. It is a research method that takes text as primary data in-

formation and obtains effective inference by mining and marking the explicit and implicit features of information [38]. Content analysis is systematic, structured, objective and quantitative. In this paper, content analysis was used to convert service touchpoints, user emotional attitudes, users' interaction and empathy reflected in the posting content into quantitative data. Referring to the research of Krippendroff [39], content analysis mainly includes three steps: construction of classification system, content data coding and reliability test.

3.2.1 *Classification system*

This research needs to judge which service touchpoint is the main focus of posting content; what emotional and cognitive feedback is generated by the touchpoint; and the intensity and scale of empathy caused by user feedback. Therefore, three dimensions of marking tasks were designed, namely, user journey map, user attitude, and word-of-mouth communication effect. All statements in each analysis unit were marked with these three categories. The statement classification criteria and operational definitions of different dimensions are as follows.

a. Customer Journey

Based on the reference works of bike-sharing customer journey [33], operational processes of electric vehicle [40] and travel scenarios of time-sharing cars [9], customer journey of time-sharing cars is separated into seven stages. See Table 3 for the touchpoints of each stage and its requirements and definitions.

Table 3 Content analysis category of customer journey.

Customer journey	Stage number	Operational definition of contacts and requirements	Examples of POS customer signal
Before service	1	**Generate demands for vehicles**	Which brand to choose; is the car easy to drive; how about the experience; be interested and want to know more……
	2	**Select the service provider: (1)** Download app; (2) Select service provider; (3) Read user notes; (4) Upload certificates, pay deposit and wait for approval	Unable to download the app with problems; the system or server is broken; expensive deposit; long wait for approval; obscure user notes; low approval rate
	3	**Select the vehicle:** (1) Browse stations and number of cars nearby by GPS positioning;(2) Check the left parking fee;(3) Select and book a car;(4) Head for the area of the targeting car;(5) Charge for delayed arrival	Too few rental stations to find easily；no car left；unable to see the car condition when booking；inaccurate GPS positioning；there are cars in stations but no cars in app
In service	4	**Scan the code to unlock:** (1) Arrive at the location of the car; (2) Observe the vehicle condition; (3) Open the app, scan the code to unlock (or unlock with face recognition); (4) Unlock successfully and start to use	Difficult to find the car return sites；terribly broken car body；broken parking pile; insensitive code scanning to unlock
	5	**Start to use**(1) Check the interior of the car; (2) Be familiar with different functions in the car(mileage, starting, light, air conditioner, gear); (3) Start to drive	Terrible interior environment with peculiar smell；unfamiliar with some functions inside the car；unable to start the engine；accelerator and brake go wrong；unable to use air conditioner, wiper and light due to damaged performance；no electricity suddenly；endurance mileage is different from the actual situation；blow-out；terrible driving experience
	6	**Return the car and check out:** (1) Search for stations for return; (2) Park the car; (3) Take and upload pictures of the exterior and interior of the car; (4) Scan the code to lock; (5) Pay the bill	Few return sites；no evident signs for return sites；limited number of places for car return in return sites；few promotion activities；system software failure；over-deduction；delayed deduction
After service	7	**Post-use feedback:**(1) Know about consumption conditions; (2) Feedback for violation and car body wear; (3) Score and upload feedback; (4) Refund the deposit	Complicated procedure for deduction refund and long wait；the efficiency of customer service to solve problems；insurance claim；unreasonable claim；violations handling

b. User's emotional attitude

The public signals of customers also contain a great deal of information about users' emotional attitudes, such as satisfaction, dissatisfaction, trust, loyalty, concern and expectation. A large number of studies have proved that customer satisfaction is an indispensable factor affecting customers' continuous use behavior [41]. In addition, shared services users worry about the security and reliability of shared products, the improper use behavior of other collaborative consumers, and the higher risk of personal information security disclosure [42-44] when choosing services, leading to the fact that users prone to show their distrust of shared services. Trust plays a moderating role between satisfaction and continuous use intention [45,46]. Based on existing researches, we focused on two emotional attitudes that affect the willingness to use services continuously - customer satisfaction and customer trust. Operational definitions of tags are shown in Table 4.

c. Word-of-mouth influence intensity

POS customer signals are publicly visible to other users and companies, which is also a process of online word-of-mouth (WOM) spreading in essence [47-49]. The online word-of-mouth of time-sharing car can be understood as the impact of user experience or complaints on other users, stimulating other users' emotions or interactive posting effects. Yang et al. [50] measured the interaction effect by the number of tweets, comments and likes of microblog when studying the behavior of attracting fans by microblog celebrities. Combined with the user interaction characteristics of Baidu Forum, this study selected the number of comments, that is, the number of replies to the theme post, to define the influence intensity of word-of-mouth.

Table 5 shows tagging results of each customer journey stage and emotional attitude in overall samples after manual marking, as well as the numbers of sample posts with different word-of-mouth influence intensity.

3.2.2 *Data encoding*

Four project members who have used time-sharing car service before and received pre-coding training will code POS data independently to ensure that each analysis unit had independent coding results from two members.

In the pre-coding training stage, firstly let the coding personnel be familiar with the operational definitions in the item tables, then select 500 theme posts and their replies, and make the coding personnel mark the corresponding categories. The consistency test result of the initial mark was 74.5%. After marking, the coding staff focused on discussing the marking results with difference. If the coding personnel have wrong understanding of the operational definitions, let them update their understanding; if the item definition is ambiguous, then the operational definition should be improved.

In the formal coding stage, the consistency test results were better than those in the pre-coding stage, thus the reliability test passed. Finally, for inconsistent coding results, the two coding personnel discussed them together until a consensus was reached [37]. The coding results of customer journey and emotional attitude are shown in Table 4.

3.2.3 *Consistency test*

In order to ensure the coding reliability, Cohen's Kappa coefficient was used to calculate the consistency test. The result in the range of no less than 0.8 is acceptable. Cohen's Kappa coefficient formula is:

Table 4 Content analysis catalog of emotional attitudes.

Code number	Operational definitions of emotional attitudes	Examples of POS customer signal
0	No evident emotional attitude	Help seeking after violation; help seeking or consultation for unfamiliarity of app functions or vehicle functions; building user groups; consultation for car use; post advertisements; posts about card or coupon sale; posts about job-hunting
1	Dissatisfaction: unreasonable price, bad service level and usability, gap between expectations and reality, poor experience	Broken server; inability to login; annoying customer service; unreasonable deduction; inability to return the car with irritation
2	Distrust: concerns about danger of epidemic infection, platform breakdown, inability to refund deposition, insufficient vehicles, out-of-electricity on half-way, no person liable for accidents, the vehicle itself, vehicle violations on the road, etc.	Worries about unavailability to refund deposition, the termination of app's operation, inability to return the car, terrible interior environment and no regular disinfection
3	Positive emotional attitude	Recommendation for brands or vehicle models; sharing pleasant experiences of car use; considerations of difficulties of maintenance personnel; praise for some activities or brands

Table 5 Statistical results of each dimension category.

Customer journey	2018 (%)	2019 (%)	2020 (%)	Users' emotional attitudes	2018 (%)	2019 (%)	2020 (%)	Word-of-mouth influence intensity	2018 (%)	2019 (%)	2020 (%)
Stage 1: Generate demands for vehicles	14.4	12.6	16.9	Total negative emotional attitudes	36.4	47.4	49.8	High (≥15)	1.9	1.1	11.3
Stage 2: Select the service provider	5.3	6.6	7.4	Dissatisfaction	11.8	17.3	20.4	Medium (3-14)	27.5	25.7	70.3
Stage 3: Select the vehicle	4.8	5.4	5.1	Distrust	16.9	16.0	19.6	Low (2≥)	70.6	73.3	18.4
Stage 4: Scan the code to unlock	2.2	1.9	3.6	Dissatisfaction and distrust	7.7	14.1	9.8				
Stage 5: Start to use	14.3	18.5	13.3	Positive and no emotional attitude	63.6	52.6	50.2				
Stage 6: Return the car and check out	13.1	23.2	22.2								
Stage 7: Post-use feedback	61.1	62.3	64.3								
Total					100	100	100		100	100	100

$$k = \frac{p_o - p_e}{1 - p_e}. \tag{1}$$

For example, i and j are two coding members; m is the type of mark results. In this coding task of emotional attitudes: "no explicit expression of emotional attitudes"=0, "dissatisfied"=1, "distrust"=2, and "positive emotional attitudes"=3. There are 4 types of marks, m =1, 2, 3, 4. The total sample size is recorded as n. In Cohen's Kappa coefficient formula, p_o is the sample proportion with the same marks of member i and j; p_e is the Expected Consistency Ratio by Chance, which is calculated based on samples with inconsistent marks of each type.

$$p_e = \frac{1}{n^2}\sum_{m=1}^{4} f_{im} \cdot f_{jm}. \tag{2}$$

where, f_{im} is the proportion of the samples marked as category m by member i that are different with the results marked by member j. f_{jm} is the proportion of samples marked as category m by member j that are different with the results marked by member i.

Cohen's Kappa coefficient k in this study all passed the consistency test with the results of 85.4% in 2018, 84.3% in 2019 and 86.4% in 2020.

3.3 Association rule mining of customer journey, emotional attitude and WOM

Association rule analysis can explore the association relationship between variables in the dataset and calculate the association strength between variables [50]. Association rules can establish an association matrix between categories in the same dimension or across dimensions according to the frequency of co-occurrence of key categories in morpheme materials, and finally obtain strong association rules of different user feedback categories. For instance, discussion about unsafe driving, invalid complaints and poor service experience often appears in many sample posts together, indicating that there is a strong association rule between the "start to use" and "post-use feedback" categories in the customer journey dimension and the "dissatisfaction" category in the emotional attitude dimension. Association rules can help analyze which service stages of time-sharing lease interact with each other, which stages are most likely to cause users' dissatisfaction or distrust, and which stages prone to cause negative word-of-mouth diffusion.

As shown in Fig. 1, after completing content analysis coding, each sample post has a series of category tags. Category tags appearing in the same sample post are defined as having a link. To begin with, the incidence matrix is generated by linking the categories. Find out all large item sets from the incidence matrix, that is, two or more item (category) groups whose co-occurrence frequency accounts for more than the minimum support in the total number of sample posts. After that, association rules are generated. Calculate the confidence of all high-frequency item groups. If the minimum confidence is met, this rule is called a strong association rule.

The support rate related to association rules is,

$$R_s(c_i, c_j) = P(c_i c_j) = \frac{N(c_i c_j)}{N(n_a)}. \tag{3}$$

The confidence rate is,

$$R_c(c_i \leftarrow c_j) = P(c_i | c_j) = P(c_i c_j)/P(c_j). \tag{4}$$

In Eqs. (3) and (4), c_i and c_j can be different categories within the same dimension, such as "start to use" and "post-use complaints" of journey categories; they can also be categories of different dimensions, such as "start to use" category of customer journey and "dissatisfaction" category of emotional attitude. The whole process is completed by Apriori algorithm.

4 Results

4.1 Unpleasant touchpoints of time-sharing car

In the years from 2018 to 2020, along with the financing boom, the leading enterprises of time-sharing car were expanding their urban operating areas and car fleets, and sales volume of the whole

market was increasing from 3.65 billion yuan in 2018 to 9.2 billion yuan in 2020. However, according to consumer feedback, the service quality of time-sharing car had declined. The proportion of dissatisfied or distrustful posts had gradually increased from 36.4% in 2018 to 49.8% in 2020, when nearly half of the theme posts radiated negative emotions.

Distribution of unpleasant touchpoints are investigated to identify which service stages were mainly responsible for users' negative emotions. In statistics process of content analysis results, if a sample post is marked as "dissatisfied or distrustful" in the emotional attitude dimension, and has one or more stage marks in the customer journey dimension, it is considered that all those stages of the customer journey produce unpleasant contact points.

It can be seen from the thermodynamic diagram in Fig. 2 that unpleasant touchpoints mainly gathered in stages 5, 6 and 7 of the customer journey. The line chart of Fig. 2 shows that the number of dissatisfied posts caused by "post-use feedback" in stage 7 was always the highest, accounting for 25.5% in 2018, rising further in 2019, and reaching 35.6% in 2020. In other words, more than 1/4 of the theme posts in Baidu Forum discussed after-sales service. Besides, there were also many problems occurring in stage 6 of "car return and settlement" and stage 5 of "Start to use". In addition, the proportion of negative posts caused by these two stages had risen significantly in 2019 and 2020. Particularly, stage 6 of "car return and settlement" had surpassed stage 5 after 2019 and became the second most problematic service stage, accounting for 12.4% of unpleasant posts in 2020. It shows that time-sharing car enterprises still followed the old thinking mode of cash-burning to expand the scale of users, without the ingenuity to improve service quality by carefully studying the user experience.

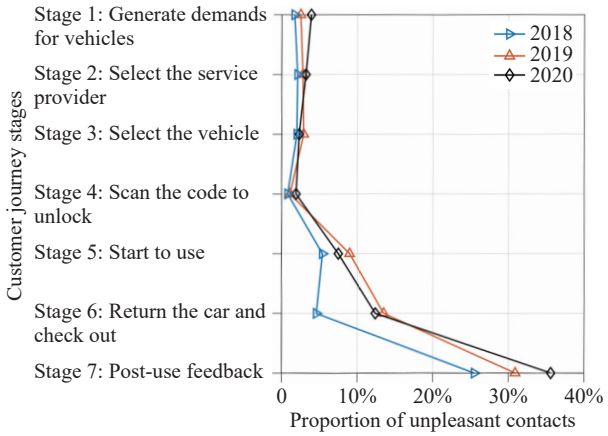

Fig. 2 Proportion of unpleasant contacts in different customer journey stages.

Fig. 3 lists the high-frequency statements related to unpleasant touchpoints of stages 5, 6 and 7 found in the content tag process. High-frequency complain statements reflect many operation and management problems of the time-sharing lease platform, which can be summarized into 5 types- "product", "technology", "service awareness and sense of responsibility", "volume and operation scale", and "relationship with operating partners".

(1) Unpleasant touchpoints caused by defects of shared products. In stage 5, dissatisfied or distrustful feedback is mainly shown in "unexpected flameout during driving", "tire blowout during driving", "inaccurate battery SOC estimation", and "some rentable shared cars cannot be used normally", levelled at the operating car fleets. All those problems happen because around 2019, time-sharing lease companies have committed to increasing rental locations and launching new vehicles. Meanwhile those old vehicles were not repaired in time after being taken back from the shelf.

(2) Unpleasant touchpoints caused by operation scale. As time-sharing lease companies have concentrated on expanding their layout, the negative reputation on vehicle convenience was not so prominent. Only few posts showed feedback of "far fewer rental cars" and "parking spaces are too scarce to return the car" in stage 6. What is more noteworthy was the feedback of "bankruptcy", "trouble of getting back deposit", "complex and long cycle of deposit refund procedures" in stage 7, caused by the capital chain rupture after the blind expansion of scale. It can be seen that the problem of time-sharing lease enterprises is not their insufficient scale, but their excessive scale, which exceeds their asset safety supervision and revenue capacity.

(3) Unpleasant touchpoints caused by poor relationship with operating partners. In stage 6, high-frequency complains of "too scarce parking spaces to return the car" and "parking fees are required when leaving the parking lot" are caused by disagreements on flexible parking spaces with the partner of parking lots. In stage 7, complains of "the long interval between the notice of violation and the car return" is caused by the ineffective information synchronization between the time-sharing lease enterprises and the transport authorities. These user feedback reflects that time-sharing lease enterprises do not have enough say in business cooperation, thereby making their operation level restricted by operating partners.

(4) Unpleasant touchpoints caused by the lack of service awareness and responsibility. In stage 5, feedback of "unclean cabin environment" and "under-inflated tires" is caused by the lack of service awareness. In stage 7, feedback of "unhandled and unresolved customer service complaints" is caused by the neglect of duty after service to a certain extent. But these problems cannot be well solved without good cooperation between after-sales departments and operating departments. The key is to improve the technical and service level in the whole operation process.

(5) Unpleasant touchpoints caused by technical defects. In stage 6, sporadic discussion such as "the car is not returned by accident with the subsequent billing", "the journey is 0 km but the billing is 70 yuan" is all caused by occasional bugs in app system. For another example, in stage 5, there was some feedback of "nsanitary interior of the vehicle", "insufficient wheel pressure", "serious vehicle failure or damage", "sudden flameout during driving", "tire blowout during driving". For one thing, they are caused by delayed maintenance and cleaning, low service awareness or insufficient maintenance personnel; for another, they are caused by the lack of self-detection technology for vehicle conditions. Time-sharing lease operation requires many information systems and vehicle control technologies to work together, including vehicle positioning and monitoring system, charging system, billing and order management system, vehicle distribution, scheduling, maintenance and repair system, etc. Technical defect is a deep-seated problem behind many negative feedback messages and the most critical problem of time-sharing lease.

Among all the technical defects, the lack of user supervision technology is the most serious. In stage 7, many posts complain about "inaccurate punishment for violation", and "inaccurate confirmation of accident responsibility". This means no monitoring equipment installed inside or outside the shared car. In order to remedy this problem, users' mutual supervision policy is made by car-sharing enterprises, which caused complaints of "taking pictures of the whole car body before use, taking pictures of the interior after use, and the next user can accuse the previous user for illegal parking, scratching and other problems" in stage 5. It seems that this policy cannot identify the fault of the previous user accurately, but adds burden to users, and dispels user's interest.

4.2 Influence of unpleasant touchpoints

4.2.1 User's emotional attitudes and WOM

Unpleasant service contacts will directly affect the repurchase behavior by influencing the user's emotional attitude, or indirectly

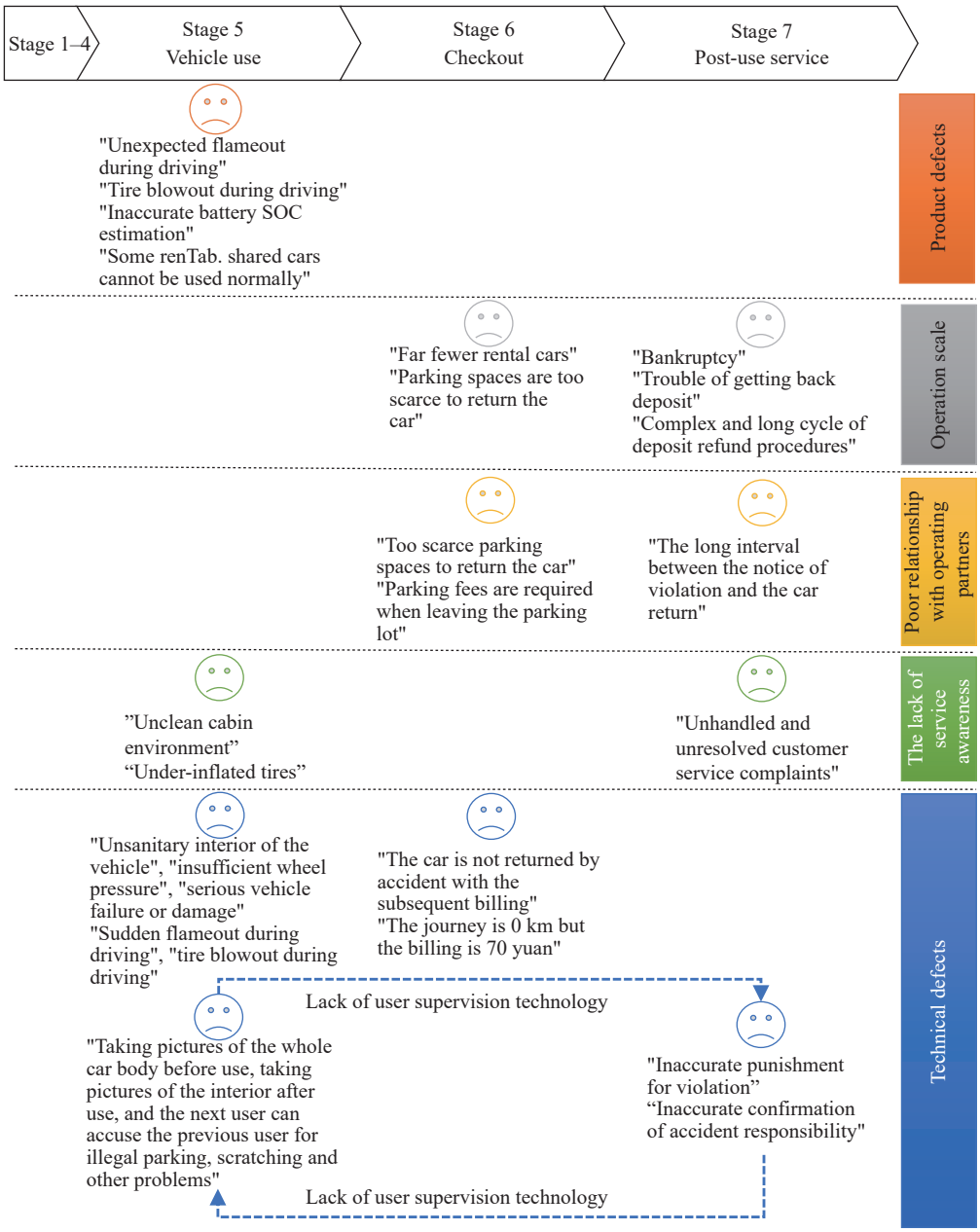

Fig. 3 High-frequency statements related to unpleasant touchpoints in stages 5, 6 and 7.

affect it by influencing the negative word-of-mouth [51-59]. Although user discussion posts cannot directly verify the impact of unpleasant contacts on repurchase behavior, they can verify their impact on users' emotional attitudes and online word-of-mouth. Furthermore, through specifically analyzing which service stage is the significant path, the impact of key touchpoints on repurchase behavior and even on the market penetration can be inferred.

With the help of the research method introduced in Section 3.3, the Apriori algorithm is used to calculate the frequency of co-existed items in the sample post and establish the correlation matrix between them. After that, the correlation intensity is defined according to the correlation frequency between items of each dimension. Table 6 shows the strong association rules between customer journey stages and users' emotional attitudes, and Table 7 shows the strong association rules between emotional attitude category and the word-of-mouth intensity. It can be seen that Stages 5, 6 and 7 are most likely to lead to dissatisfaction, distrust or both.

In order to avoid over-complex relationship among various categories, which will make the impact mechanisms in Fig. 4 indistinguishable, the minimum support and confidence of strong association rules are set to be 3% and 20% respectively according to the research suggestion of Gutman et al. [60] with the combination of the actual situation of time-sharing lease. In this way, a more detailed diagram of impact path layer is obtained as a reference architecture for the analysis of impacts of different service stages, as shown in Fig. 4.

The thicker line in Fig. 4 represents the closer association of two category items. Association analysis found that post with both dissatisfied and distrustful attitude is more likely to bring about negative word-of-mouth than post with only distrust attitude, and post with distrust attitude can bring more than post with dissatisfaction attitude. For the ability to trigger these negative attitudes, stages are ranked as follows: stage 7> stage 6> stage 5.

There are many influence paths for each touchpoint, but there are just five worth paying attention to: Stage 5 → dissatisfaction → low and medium WOM, Stage 6 → dissatisfaction → low and medium WOM, Stage 6 → dissatisfaction and distrust → medium and high WOM, Stage 7 → distrust → medium and high WOM, Stage

Table 6 Association rules between customer journey stage and user's emotional attitude.

Customer journey consumption stage	Emotional attitude				
	No emotional attitude	Positive emotional attitude	Dissatisfaction	Distrust	Dissatisfaction and distrust
	Association rules（degree of support %，confidence %）				
Stage 1	(6.3, 55.9)				
Stage 2					
Stage 3					
Stage 4					
Stage 5	(3.5, 27.6)		(3.3, 25.8)		
Stage 6			(6.0, 39.4)		(3.9, 25.9)
Stage 7				(16.6, 3.2)	(9.8, 19.6)

Note：The results in the Table are based on the consolidated data from 2018 to 2020, and there is no significant difference between the association rules calculated from single year data and consolidated data.

Table 7 Association rules between user's emotional attitude and WOM influence intensity.

Emotional attitude	WOM influence intensity		
	Low	Medium	High
	Association rules（degree of support %，confidence %）		
No emotional attitude	(19.7, 68.5)		
Positive emotional attitude	(3.4, 57.1)		
Dissatisfaction	(12.2, 53.0)	(9.7, 42.1)	
Distrust		(10.2 44.0)	
Dissatisfaction and distrust		(9.9, 52.0)	(1.5, 7.8)

7 →dissatisfaction and distrust → medium and high WOM. Stage 5 is the vehicle use stage. In this process, discussion posts for help caused by the user's driving skills or unfamiliarity with the time-sharing car itself will not trigger too many discussion posts. However, if the post is resulted from vehicle quality problems, then it will cause dissatisfaction, leading to moderate word-of-mouth spread. Stage 6 is the phase of car return and settlement. Many discussion posts mentioned that the app billing was wrong or the signal was weak and the car could not be returned, leading to passive billing, which caused dissatisfaction or even distrust of the platform's technical level. This resulted in moderate word-of-mouth diffusion. Stage 7 is the after-sales service stage, in which a large number of accidents of user behavior misjudgment and delayed punishment for violations occurred, so more distrust was generated, which led to medium and high word-of-mouth spread.

4.2.2 Vicious circle between negative WOM and badly-behaved customers

Through content analysis of the operation problems reflected behind negative WOM, we find there is a vicious circle between negative WOM and badly-behaved customers, which is essentially caused by the lack of user supervision technology.

In section 4.1, we have discussed that the lack of user supervision technology led to very complex policy about user mutual supervision, and increased user complaints in stage 5. In fact, this technical defect not only leads to the service pain points in the car use stage, such as the scratch of the car, unsanitary interior, poor car conditions and driving accidents, but also brings about pain points in the after-sales service stage like the misjudgment of violations after return which triggers widespread negative WOM. More badly than that, in the spread process of WOM, other users will notice that "technology can not accurately determine violations". This recognition will lead to more casual behavior of some users and an increasing number of phenomena of returning cars illegally. Due to this problem, the next innocent user will probably be involved in punishment disputes or meet an accident while driving, the service difficulty of time-sharing lease will increase and users will also experience more and more pain points.

The chain reaction has already been an open secret in today's car-

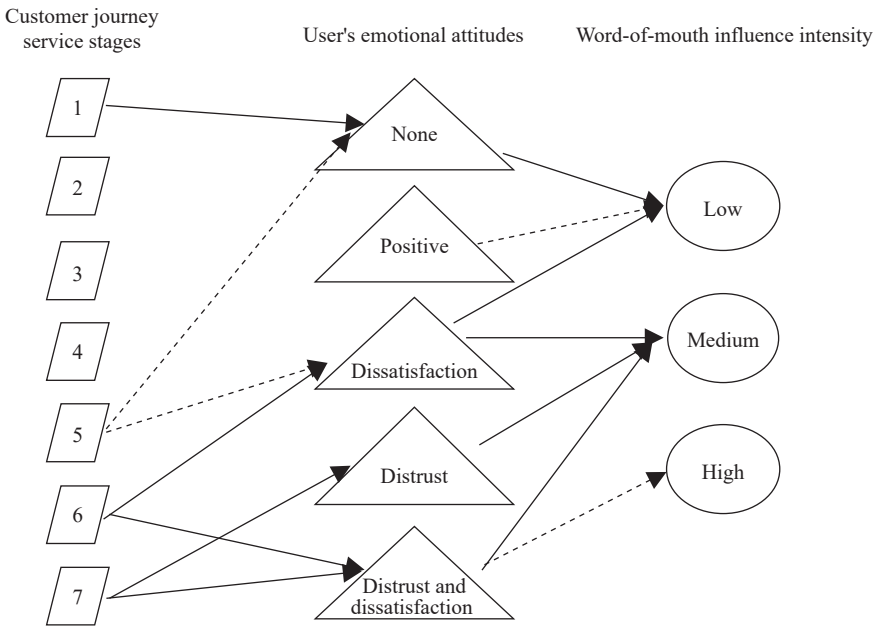

Fig. 4 Relationship between service stages, emotional attitudes and word-of-mouth.

sharing user groups, according to content analysis of user posts, see Table 8 for details. According to the broken window theory, if the undesirable phenomena in the environment are allowed to exist, people will be tempted to follow suit, and even behave worse. From the user discussion posts, we can see that such a vicious circle relationship from negative WOM to users' bad behaviors to service pain points has formed in the time-sharing service. In the long run, users will be even more fearful about the safety of time-sharing car bodies, resulting in a crisis of trust, and "persuading" many old users to quit. Bad money drives out good money, and the whole time-sharing lease system will be unsustainable.

Table 8 Negative impacts of broken window effect in user discussion posts.

Identification of user responsibility is controversial or unavailable
Theme post：The driver after me took some photos to show that the car stranded and could not move. But actually, I had really driven it for a few miles and returned it before 12 pm. Gofun is not like Linked Cloud which demands users taking photos after use. Now they insist that it is my fault! But seriously, the wall is on the left, will any normal person park the car like this? Evidently, that driver wanted to drive down this way. And now? I'm asked to compensate for this! No one should use such a blunderbuss software! It's just a simple logical problem, but they blame on me without a little thinking!
post bar：gofun，time：2020-10-12
Theme post：Gofun is absolutely annoying！ I rented their car early December last year and everything was normal, but the next day I was told to compensate 900 yuan for breaking the car door. How ridiculous! Didn't I know it if I really broke the door? I chose to make a phone call for complaint, but unexpectedly they demanded me finding evidence that I was not accounTable for it and asked for my understanding!
post bar：gofun，time：2020-5-26
Theme post：The car hit a wall, but I haven't bought Changxing service or insurance, does any buddy know what I should do?
Reply post：They may not contact you, I have seen worse situations.
post bar：Evcard，time：2020-5-04
Broken window effect
Theme post：Buddies, I have bought basic service charge for daily rent before. Now my car was scraped against the wall, what will happen if I just return the car without report?
post bar：gofun，time：2020-6-05
Theme post：Everyone should buy Changxing service fee!! My car was scraped in the garage when I was about to return it, it really sucks!
Reply post1：Just one kick and your car will reinstate, I'm sure they won't notice it, ha-ha!
Reply post2：If you can drive it away, just return the car straightly. Why should you compensate??
post bar：Evcard，time：2020-11-16
Theme post：It's not that Chang'an Travel is to blame, but that many people drive their cars as airplanes! Just check up the vehicle condition. I have also watched a video in which the Swift car was used for drifting…unbelievable! Besides, a number of cars were broken without report…
post bar：Chang'an Travel，time：2020-6-10
Theme post：I just failed to switch to reverse and the car slipped into a pit. I don't have to pay for that now that I have bought Changxing service fee, right?
Reply post：Such slight scratch, just return the car straightly.
post bar：Evcard，time：2020-7-09
Theme post：There are tire pressure alarms in all three Dongfeng vehicles，but they were still driven away after a while，what the hell??
post bar：gofun，time：2020-3-31
More unpleasant experiences were caused
Theme post：I felt something wrong after driving for hundreds of meters，then I found the wheel was broken, so I had to slip slowly to its return site for return. Unexpectedly, when I called the customer service to tell him this, he just said that the fee could not be refunded, but only a coupon could be given…
post bar：Evcard，time：2020-1-18
Theme post：I drove a car yesterday without inspection because I was in a hurry at that time. Then I found something wrong after a few minutes, but I could not pull it up due to the busy traffic. Finally, I returned it in a station which was a mile or two away and I found the tire was ragged…
post bar：Panda Travel，time：2020-7-25

5 Conclusion

Under the framework of customer journey, this paper finds that the unpleasant contacts of time-sharing service are concentrated on three stages: vehicle use process, return and settlement, and after-sales service. Unpleasant touchpoints of service reflect the problems of time-sharing service in five aspects: product, volume and scale, business partnership, technical defects and service awareness. The impact of unpleasant touchpoints mainly includes: 1) In the vehicle use stage, technical discussion posts about the unfamiliarity with vehicles usually do not cause WOM spread; while if the discussion post involves vehicle quality problems, it is easy to cause dissatisfaction and then the moderate WOM will spread. 2) In the car return and checkout stage, due to the money involved, pain points will cause distrust and dissatisfaction, followed by negative WOM. 3) After-sales service pain points, especially the misjudgment of violations after returning the car, are most likely to cause distrust and dissatisfaction, leading to high WOM. In the spread process of WOM, users with low self-discipline are told "they will not be punished", so they tend to have the idea of haphazard use of cars and illegal return of cars, resulting in the broken window effect. As a result, more service problems and more negative public praise happen, triggering a vicious circle of negative service experience.

The theoretical value of this paper are as follows. First, the key touchpoints of time-sharing lease service were identified. Compared with the existing literature, collaborative consumption, bad customers, hygiene, responsibility risk, etc. have been confirmed again in China's car-sharing business case. Beyond these problems, we found the lack of user supervision and management technology is the deepest reason for user liability risk, bad customers, hygiene and misjudgment after use. Second, the relationship chain of unpleasant touchpoints, user's negative attitude, and negative word-of-mouth communication was verified again, and a circular relationship chain was found on the basis of the existing theoretical model, which is about negative WOM causing "broken window effect" and further causing more unpleasant touchpoints of service.

6 Management suggestions

(1) Focus on the improvement of technology and service instead of expanding the scale blindly

In the period from 2018 to 2019, time-sharing lease enterprises in China have done two things. After obtaining financing, they mainly paid attention to Internet platform thinking such as expanding scale advantages. Besides, they were busy with jointly creating ecology with large platforms, struggling for MAU(Monthly Active User) and expanding the layout scale with the lack of awareness of serving long-term users well and polishing service details. With difficulties showing up, the improvement of user supervision technology and service quality has not been taken into account, but the first part to be abandoned. In 2020, in order to strengthen profitability, many time-sharing lease enterprises have reduced service costs. What is more, many enterprises used promotional methods like discount, coupon and signing in reward to maintain market share. However, without the support of safe and reliable operating vehicles and system services, those users attracted by the promo-

tion are hardly sticky. Empirical research in this study showed that these added value and promotion activities have hardly been discussed by users and thus have not formed positive WOM. This study suggests that in the contraction and transformation stage of time-sharing enterprises, they should give up blind expansion and attach more attention to the improvement of technology and service instead.

(2) Time-sharing lease car cannot replace car hailing without user supervision technology

One of the findings of this study is that the backward user supervision technology is an important reason for restricting the development of time-sharing services, which has been ignored by the industry and enterprises. Specifically, some low-quality users or novice drivers who just want to practice driving have been absorbed into the market, causing vehicle damage and hidden return after vehicle violations, which lead to high-quality users being gradually driven out of the market by poor experiences such as unsafe vehicles and unwarranted accident accountability. As a result of the vicious circle, the time-sharing lease has been losing market share in the shared travel market.

As for the question when time-sharing lease without driver can really replace online car hailing with drivers, it must be taken into account that in addition to driving, the online car hailing drivers also undertake the responsibilities of supervising passengers, protecting passengers, ensuring a clean and tidy cabin environment and vehicle safety. If it is impossible to replace labor force with technology for regulating users, shared cars with drivers will exist in the shared travel market for a long time.

(3) Ameliorating the pain points of service and blocking the spread of negative word-of-mouth start from the car use and after-sales stages

It is undeniable that the current time-sharing lease industry has limited funds, with the strategy turning from expansion to full contraction. How to use the limited funds where they are needed most to reverse the current decline is the key problem that the time-sharing lease industry faces. Time-sharing lease service does not need to concentrate on the formation of scale effect. On the contrary, it can serve one city, one district, or even one shared travel scenario, emphasizing the amelioration of service quality. In the long run, the R&D investment in user behavior judgement technologies like remote detection of vehicle components and surveillance of the internal environments should be raised to meet the application requirements of time-sharing lease as soon as possible. While in the short term, the operation and maintenance of vehicles should be strengthened, in order to comprehensively upgrade the quality of vehicle safety, cabin cleaning, and accurate operation of the app billing system. Furthermore, the investment should be raised to maintain relationship with parking lots and traffic management departments, reducing information communication cost. All of these measures can ameliorate user experiences and block the spread of adverse word-of-mouth to a certain extent.

Declaration of competing interest

The authors have no competing interests to declare that are relevant to the content of this article.

Data Availability Statement

Some or all Data, models, or code that support the findings of available from the corresponding author upon reasonable request.

Acknowledgements

This study was supported by the Research on the Characterization and Evaluation of Efficiency Enhancement in Typical Travel Scenarios within the Urban MaaS System, Open Project of the Academy of Sciences of the Ministry of Transport (No. 2023-APTS-04); Research on the reshaping of shared car travel scenarios by travel integration service MaaS, Ministry of Education of the People' s Republic of China (No. 21YJAZH098); and Research on the development strategy of private shared transportation in MaaS travel integration services, the Project of Cultivation for Young Top-motch Talents of Beijing Municipal Institutions (No. BPHR202203040).

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